ACCESSION #: 9906220090

NON-PUBLIC?: N

LICENSEE EVENT REPORT (LER)

FACILITY NAME: San Onofre Nuclear Generating

Station (SONGS) Unit 3 PAGE: 1 OF 6

DOCKET NUMBER: 05000362

TITLE: Manual Reactor Trip (ESF Actuation) Due To Feedwater

Control Valve Opening

EVENT DATE: 5/15/1999 LER #: 1999-004-00 REPORT DATE: 6/11/1999

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 024

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:

50.73 (a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:

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COMPONENT FAILURE DESCRIPTION:

CAUSE: SYSTEM: COMPONENT: MANUFACTURER:

REPORTABLE EPIX:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On 5/15/1999, at 2358 PDT, a main feedwater regulator valve moved to full open. The reactor was manually tripped when steam generator level reached the high level pre-trip alarm setpoint. All control rods fully inserted. No other ESF functions were required and

none actuated, either manually or automatically. All systems and plant responses were as expected. This event was reported to the NRC pursuant to 10CFR50.72(b)(2)(ii). This Licensee Event Report (LER) is provided pursuant to 10CFR50.73(a)(2)(iv).

The cause of this event was a faulty valve positioner. The positioner's failure was a combination by loose fasteners and the air supply nozzle restriction being plugged with dirt and dust. Plugging the supply air nozzle restriction has the same effect as the stuck pilot valve discussed above. With the restriction plugged, the pilot valve did not close and, as a result, caused 3FV1111 to open.

The faulty positioner was replaced. As a result of this event, and that in LER 3-1999-003, SCE is evaluating its preventative maintenance program.

This event is categorized as GREEN. SCE has reported no related events in the past 3 years.

Plant: San Onofre Nuclear Generating Station (SONGS) Unit 3

Reactor Vendor: Combustion Engineering

Event Date: May 15, 1999

Event Time: 2358 PDT

Unit 2*_/ Unit 3

Mode: 1 1

Power (percent): 100 24

Temperature (degrees F): 538 542.2

Pressure (psia): 2250 2250

*_/Unit 2 was unaffected by this event.

Background:

At SONGS Unit 3, condensate is supplied to the Main Feedwater System (FW)

(SJ) from the condensate system. Feedwater is directed from a common

header to three, balanced parallel-piped, low pressure sixth point heaters.

From the sixth point heaters, the feedwater flows into a common header. The system then branches into two parallel trains of four low pressure heaters. From the low pressure heaters, the flow is directed to two turbine driven, 50 percent capacity, FW pumps (P). The FW pumps operate in parallel and discharge into two interconnected lines that flow to the first point high pressure heaters. From the first point heater, the feedwater flows through the FW regulating valves (FCV) (3FV1111 and 3FV1121) to the steam generators. See Figure 1.

Each steam generator has a separate and independent Feedwater Regulation Control System (FWRCS). The FWRCS is a three element control system (LC) (actual level, steam flow, and feedwater flow). Proper steam generator level is maintained by comparing actual steam generator level to its programmed level. A rate of change circuit utilizes any difference between steam flow and feedwater flow to adjust for system transients (shrink and swell).

Main feedwater flow rate is controlled by a combination of main and bypass control valve position', and feedwater pump speed. The main feedwater pump speed setpoint signal is a function of the larger of the flow demand signals from each of the FWRCSs. At low flow conditions, the pump speed setpoint program demand signal provides for a predetermined minimum speed. As flow requirements increase, the speed of the pump is increased at a proportional rate.

Each of the main feedwater regulating valves respond to a generated

feedwater flow demand. At low power, the feedwater regulating bypass valve controls feedwater flow. At intermediate power, the main and bypass feedwater regulating valves share control of feedwater flow. At high power, the main and bypass feedwater regulating valves are essentially open and main feedwater pump speed is the primary mechanism for flow control, minimizing the pressure drop across the regulating valves.

The main feedwater regulating valves are air operated angle balanced plug valves with a piston pneumatic operator. The piston is operated by an air operated direct-acting actuator. The feedwater regulating valves are pneumatically controlled. The pneumatic control system consists of a Moore 77-16 I/P (current to pressure) converter module, a Moore 750P valve positioner, two Moore model 61 H F/R booster relays designed to meet high speed control applications, and two ASCO model HV 200-924-IU, three-way solenoid valves. The solenoid valves are operated by 120 VAC power and have their exhaust ports plugged. On loss of air or electrical signal, the actuator will lock the valve in the position it is in, causing it to fail "AS-IS."

The feedwater pumps' design discharge pressure is 1125 psig and the pumps automatically trip on high discharge pressure at 1500 psig.

Description of the Event:

On May 15, 1999, at 2358 PDT, with Unit 3 at 24 percent power, main feedwater regulator valve 3FV1111 moved from its normal 24 percent power

position to full open. (Reference AR990501305) Attempts by the operators (utility, licensed) to manually control steam generator level were unsuccessful. The reactor was manually tripped when steam generator E089's level reached the high level pre-trip alarm setpoint. All control rods fully inserted. No other ESF functions were required and none actuated, either manually or automatically. All systems and plant responses were as expected.

This event was reported to the NRC Operations Center (Log No. 35721) pursuant to 10CFR50.72(b)(2)(ii). This Licensee Event Report (LER) is provided pursuant to 10CFR50.73(a)(2)(iv).

Cause of the Event:

The cause of this event was determined to be a faulty valve positioner on 3FV1111. The positioner failed in such a way as to cause the feedwater regulator valve to move to full open. The positioner's failure was a combination by

1. The return spring in the control diaphragm was found to be cocked and as a result, the diaphragm did not spring back to close the pilot valve. With the pilot valve stuck open, air continued to be supplied to the bottom of 3FV1111's piston actuator, causing it to open.

The cause of the stuck return spring was loose mounting screws, calibration screws, and nuts. The screws were found to be 1/4 to 1 turn loose. The screws likely loosened due to long term

inservice vibration.

2. The air supply nozzle restriction was found to be plugged with dirt and dust. Plugging the supply air nozzle restriction has the same effect as the stuck pilot valve discussed above. With the restriction plugged, the pilot valve did not close and, as a result, caused 3FV1111 to open.

Corrective Actions:

o The faulty positioner was replaced.

o As a result of the event reported herein, and in LER 3-1999-003 1, SCE is evaluating its preventative maintenance program for the FWRCS.

Safety Significance:

This event was evaluated using the NRC's draft Significance Determination Process (SDP). The reactor was manually tripped and all control rods fully inserted. No other ESF functions were required and none actuated, either manually or automatically. In accordance with the SDP, this event affected only one cornerstone - Initiating Event. Because this condition did not contribute to either the likelihood of a Primary or Secondary system LOCA initiator or the likelihood that mitigation equipment would not be available,, no Phase 2 or 3 review was required. This event is categorized as GREEN.

Additional Information:

A. On May 12, 1999, operators noticed that:

1. 3FIC1111 output was 67 percent and 3FIC1121 was 77 percent while at approximately 90% power. This caused less than optimum main feedwater control.

2. Both main feedwater regulator valves unexpectedly went to the normal, expected 70 percent open. The resulting feedwater flow perturbation caused both SG levels to oscillate, but the FWRCS stabilized both steam generator levels with no operator intervention. When the oscillations were over. the system was behaving normally.

It was during the investigation of these system disturbances that the Unit trip reported in LER 3-1999-003 occurred. The cause of these disturbances could not be determined conclusively. However, both can be explained by either 1) the cause of the event reported in LER 3-1999-003 (high contact resistance caused by fine debris on the relay contact), or 2) the cause of the event reported herein (faulty main feedwater regulator valve positioner). or a combination of these two. It should be noted that the FWRCS is normally "tuned" during startup from a refueling. The tuning, which is completed at full power, was still in progress at the time. Therefore, the system's performance was not optimum and could have contributed to the observed feedwater flow perturbation.

B. On May 14, 1999, during pre-startup valve stroking operations, the

four valve actuator hold down cap screws on 3FV1 121 were discovered to be broken or cracked. Failure analyses of the cap screws determined the four cap screws had loosened during operation because of normal system vibration. The loosened cap screws then cracked by fatigue and two ultimately broke under bending stress. The cracked and broken cap screws were not caused by either the event reported herein or in LER 3-1999-003. However. the loose actuator could have contributed to main feedwater control problems by causing a mismatch between valve position and positioner demand.

The four stainless steel cap screws were replaced with higher tensile strength carbon steel cap screws. The carbon steel cap screws are less susceptible to fatigue failure. Similar valve actuator cap screws on Units 2 and 3 were inspected. All the cap screws were tight, but their condition (cracking and torque) were not be determined during plant operation. 2FV1111 has stainless steel cap screws, which will be replaced with carbon steel cap screws at the next opportunity.

C. In the past three years, SCE has reported the following ESF actuations:

1. LER 3-1999-003 reported a manual reactor trip when a feedwater regulating valve closed, tripping the main feedwater pumps on high discharge pressure. The cause of that failure was fine debris on a main feedwater control system relay contact . The

corrective actions for that event would not have prevented the event reported herein.

2. LER 2-1999-001 reported the start of an emergency diesel generator on the loss of voltage on the 4.16 KV emergency bus. However, the causes (human error in combination with a transformer ground which had been installed for planned maintenance) were different from the event reported herein, and the corrective actions taken could not have prevented the event reported herein.

3. LER 2-1998-017 reported the manual isolation of the control room air intake by actuating the control room Toxic Gas Isolation System (TGIS) when an operator detected the faint odor of chlorine. The cause was a sulfuric acid storage tank leak. While the cause of the leak was equipment failure, that event and the one reported herein are not related, and the corrective actions taken for the acid leak could not have prevented the event reported herein.

4. LER 3-96-001-01 reported the automatic start of both emergency diesel generators on a loss of voltage signal on the emergency bus. The signal was caused when a Test Technician inadvertently actuated a relay. The cause (human error) was different from the event reported herein, and the corrective actions taken could not

have prevented the event reported herein.

Figure 1 "Main Feedwater Flow Diagram" omitted.

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